



Forest Health Protection

Pacific Southwest Region

Northeastern California Shared Service Area

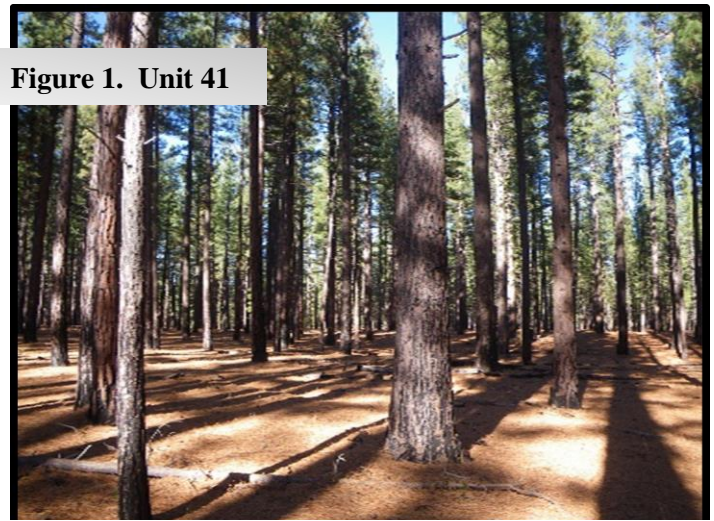
Date: February 7, 2018
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To: District Ranger, Sierraville Ranger District, Tahoe National Forest

Subject: Forest pest evaluation in Unit 41 of the Saddle Project (FHP Report NE18-01)

On November 29, 2017, Danny Cluck, Forest Health Protection (FHP) Entomologist and Bill Woodruff, FHP Plant Pathologist along with Tony Balderas, Sierraville RD Forester evaluated Unit 41 in the Saddle Project for forest pest issues to be considered in the development of the silvicultural prescription for the stand. Unit 41 is mostly second-growth ponderosa pine (*Pinus ponderosa*) (Figure 1) with scattered Jeffrey pine, (*Pinus jeffreyi*) incense cedar (*Calocedrus decurrens*) and white fir (*Abies concolor*) located in the Wildland Urban Influence Defensible Fuel Profile Zone (WUI/DFPZ) 0.2 mile northeast of Calpine, CA. Unit 41 is on the west side of the relatively flat Sierra Valley at about 4975 feet elevation near where the forest transitions into ranchland approximately 1500 feet to the east. (Figure 2). A hiking trail used mostly by residents of Calpine passes near the southern boundary.

Figure 1. Unit 41



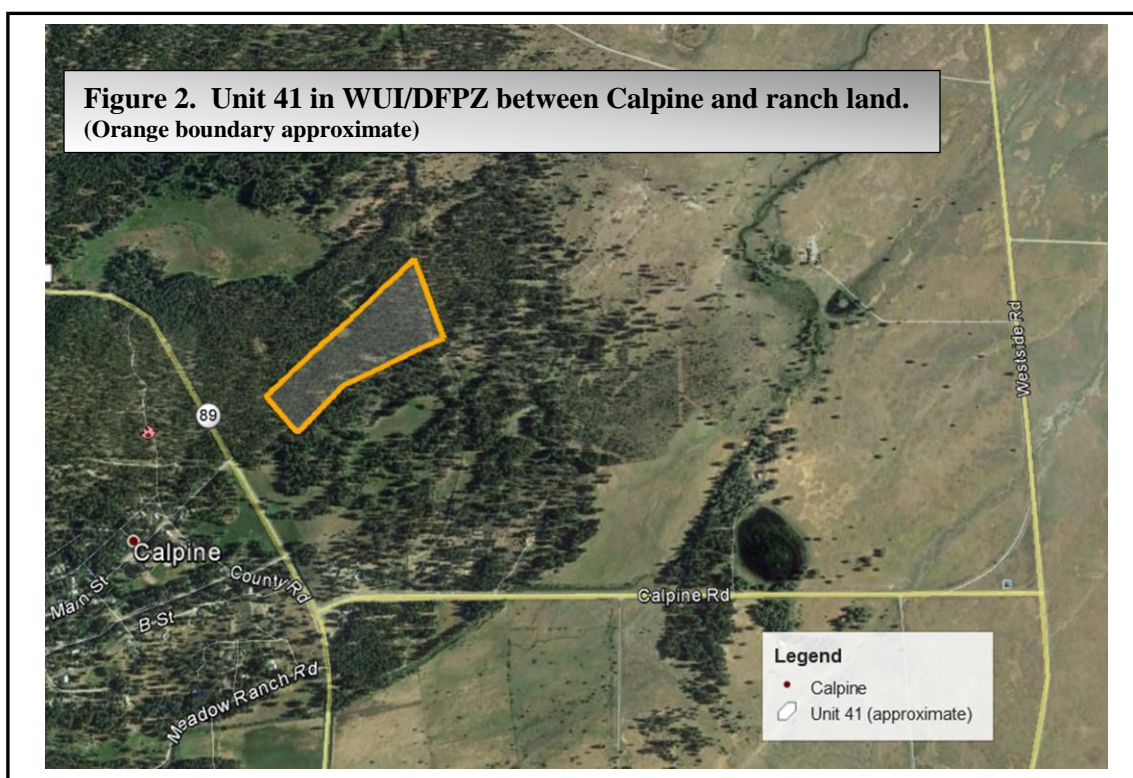
Unit 41 is a site class 3 eastside pine stand. Hardly any forest pest issues were identified during this evaluation. The lack of pest issues is likely due to the light thinning completed in 2008 and the prescribed under-burn conducted in 2009. These treatments removed or destroyed the least healthy trees and most of the conifer seedlings and other plants growing on the forest floor. One dead pine was found which probably died slowly from cambial damage sustained during the 2009 burn.

Eight years after the burn, the forest floor is almost free of vegetation, indicating that the site is fully or overstocked with trees which keep most sunlight from reaching the ground. The problem with maintaining too many trees on a site is that many will eventually suffer bark beetle-caused mortality during extended droughts which occur regularly in California. Reducing the basal area from the current 280 square feet per acre to 120 or lower should result in more available soil moisture and improved resiliency. With enough space, sunlight, nutrients and water, trees have the capacity to grow and thrive. With adequate water, trees produce resin which reduces their



susceptibility to successful bark beetle attacks. More sunlight to the ground will encourage understory vegetation growth which could add excessive fuels to the DFPZ and periodically require treatment. Any openings created in Unit 41 for conifer regeneration could also grow new vegetation needing periodic fuels treatment.

Thinning to a relative density of 25 - 40% of the maximum Stand Density Index (SDI) will effectively reduce competition for limited water and nutrients and reduce the susceptibility to future bark beetle-caused tree mortality. For Unit 41, the District is considering basing relative density targets based on an SDI_{max} of 450. Since this is an eastside pine stand, the District should also consider using the bark beetle limiting SDI of 365 as a basis for thinning prescriptions. SDI₃₆₅ is considered the upper management zone above which bark beetle outbreaks are likely to occur and SDI₂₃₀ is considered the threshold for the zone of imminent bark beetle caused mortality. Within this zone, endemic populations kill a few trees but net growth is still positive (Oliver 1995). Planning thinning treatments that result in stocking levels well below SDI₂₃₀ would greatly reduce the risk of bark beetle caused mortality in these areas but may not be compatible with DFPZ objectives.



Western pine beetle (*Dendroctonus brevicomis*) was found attacking two ponderosa pine (PP) trees inside the unit and a very small 3-tree group of PP mostly outside Unit 41. More beetle attacks can be expected, especially during droughts, if tree density in unit 41 is not significantly reduced.

Symptoms of old porcupine damage (forked tops and crooks with aborted leaders) are present throughout the unit on a small number of large pines. These should be evaluated for their wildlife value. Consider leaving extra tree density around wildlife trees. All hazard trees within striking distance of the hiking trail should be removed or fallen.

In order to prevent top kill and/or mortality from bark beetles (*Ips spp.*), green slash (>3" diameter), logs or bundled trees (doodles) should not be left scattered throughout the stand from January through June. This material needs to be removed or treated soon after it is created

Heterobasidion root disease has been recognized as a problem in California forests, especially in eastside pine stands, for more than three decades. A thorough discussion of this fungal disease is attached. *Heterobasidion spp.* spores are carried by air currents long distances where they readily infect conifer stumps when they land on freshly cut surfaces. Heterobasidion root disease can be effectively controlled by treating freshly cut host stumps with borate fungicides. Therefore, in Unit 41 all freshly cut stumps larger than 14 inches in diameter should be treated with either Sporax (no longer available except for supplies on hand) or CelluTreat to prevent *Heterobasidion spp.* from infecting stumps and then roots. Once in the roots, the disease can remain for decades and result in expanding disease centers and tree mortality. Consult Forest Service Handbook R5 Supplement 3409.11-2010-1 and the attached '*Heterobasidion root disease biology*' for more information on heterobasidion root disease and management considerations.

If you have any questions regarding this report and/or need additional information please contact Bill Woodruff.

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Heterobasidion root disease biology

Heterobasidion spp. is a fungus that infects primarily conifers on all National Forests in California; with incidence particularly high in true fir stands in northern California, in eastside pine type forests, and in southern California recreation areas. While Heterobasidion root disease is a natural part of most forest ecosystems in the West contributing to structural and species diversity, incidence and impacts in many California forests have increased in recent decades due to management practices. Heterobasidion root disease is found on all western conifer species but is of most concern on true firs, hemlocks (western and mountain) and pines (ponderosa and Jeffrey). Incense cedar, coast redwood and sequoia are sometimes infected in California. Western juniper is infected throughout its range.

Heterobasidion is an important stress-causing agent and its negative impacts on root systems result in predisposing conifers to bark beetle attack. In true firs severely affected by Heterobasidion root disease, the water absorbing and conducting parts of the root system are progressively diminished and eventually water lost to transpiration cannot be replaced at a fast enough rate. This leads to moisture stress, especially towards the top of the tree, and predisposes the tree to fir engraver attack. In pines affected by this disease, root systems are similarly impacted and the trees become more susceptible to pine bark beetles.

Heterobasidion spp. was considered a single species (*Fomes annosus*) until thirty years ago. Heterobasidion root disease in western North America is now reported to be caused by two species: *Heterobasidion occidentale* (also called “S-type” [spruce]) and *H. irregulare* (also called “P-type” [pine]). These two species of *Heterobasidion* have major differences in host specificity. *H. irregulare* (P-type) infects ponderosa pine, Jeffrey pine, sugar pine, Coulter pine, lodgepole pine, incense cedar, western juniper, pinyon, and manzanita. *H. occidentale* (S-type) infects true fir, mountain hemlock, Douglas-fir, giant sequoia, coast redwood, western hemlock and spruce. Both Heterobasidion species can infect stumps of non-hosts as saprophytes; however the fungus very rarely spreads from a non-host to a host species, either between trees or stumps and trees.

The typical pattern of Heterobasidion root disease in pine stands is scattered dead pine trees centered around large old pine stumps. There are often old dead snags and downed trees with rotten roots near the stumps and more recent mortality and symptomatic live trees further away. Mortality usually does not start to occur around stumps until 15 or more years after they are created.

In true fir stands, Heterobasidion root disease often does not produce obvious evidence of infestation. Mortality is infrequent to rare in standing trees, but large true fir trees with extensive root and butt rot may be broken or windthrown; and have declining crowns and dead branches. Other infected true fir trees of all sizes may have green crowns with poor height growth and dead tops from successful fir engraver attacks. Sometimes the presence of *H. occidentale* is only discovered when a stand is thinned or harvested and decay and stain is observed in the stumps.

Colonization of freshly created stump or wound surfaces by germinating spores is a critical stage in the disease cycle. Conks (fruiting bodies) produce spores which disseminate throughout the year, but depend on favorable environmental conditions for successful germination and establishment. Temperature is important for successful infection of stump surfaces. Spores are inactivated after 60 minutes above 113° F (45° C). Actively growing mycelia can be killed at temperatures above 95° F (35° C). However research suggests that microbial activity at the stump surface plays a synergistic or interactive role in stump infection. Therefore both 95° F temperature and microbes are thought to be needed to stop *Heterobasidion* spp. at the stump surface.

Stumps are susceptible to infection immediately after cutting. Ponderosa and Jeffrey pine (PP/JP) stumps remain susceptible to infection for 2 to 4 weeks. The decrease in susceptibility with time probably results from colonization of the stumps by other microorganisms that compete with and replace *Heterobasidion*. Vertical penetration of fungal hyphae into stumps depends on temperature and extent of tree injury from other sources. In PP stumps, the rate of vertical penetration averages 3 inches/month from October through May and 5 to 6 inches/month from June to October.

Preventive actions may include implementing silvicultural treatments to lessen stand susceptibility to *Heterobasidion* root disease such as thinning, species management, and minimizing logging damage and other injuries. However, many silvicultural treatments leave stumps behind; therefore prevention of *Heterobasidion* root disease usually includes treatment of freshly-cut conifer stumps with a fungicide. The probability of infection of freshly cut conifer stumps can be reduced by applying a registered borate fungicide soon after the tree is felled. Studies indicate that stump treatment with borates has at least a 90% efficacy in preventing infection under conditions that would otherwise have led to stump colonization by *Heterobasidion* spp. Borates are toxic to recently germinated spores of these fungi but they do not have an effect on existing infections. Therefore true fir stands with most of the roots chronically infected may not benefit from borate stump treatment. Borate treated PP/JP stumps 14" and larger will usually be effective in limiting *Heterobasidion* root disease in stands where existing host conifers have root contact with the roots of treated stumps.

When a stand is cleared, by clearcutting or wildfire salvage logging, and planted with PP/JP seedlings, *Heterobasidion*-caused seedling mortality can only occur when a root of a seedling grows into contact with an infected pine root. The years it takes a PP/JP seedling root to grow into contact with a root of an infected pine stump provides opportunity for soil microbial activity to colonize and begin decomposition of the stump root; thereby excluding *Heterobasidion*. Small roots are colonized and decomposed fastest; larger roots require many years. The smaller a PP/JP stump, the smaller its roots and the more likely the roots will be colonized by competing organisms; making them incapable of spreading *Heterobasidion* spp. The preceding discussion may explain why in four eastside pine stands surveyed on the McCloud Ranger District, Shasta-Trinity National Forest in 1988, untreated pine stumps less than 30" in diameter had less than 10% infection rates from *Heterobasidion* spp. Twenty years of informal monitoring of JP/PP planted clearcuts on private and public lands in northeastern California found minimal seedling mortality in clearcuts where stumps were not treated with borates. Usually one or two planted seedlings located next to an occasional very large infected pine stump or two in each clearcut are killed by *H. irregulare* within a decade of planting; and the disease appears to stop there; suggesting no need to treat stumps in clearcuts and fire clearings where PP/JP seedlings will be planted. When a true fir stand infested with *Heterobasidion* root disease is cleared and planted with pine seedlings, stump treatment is also unnecessary because *H. occidentale* typically does not kill pine seedlings.

References

USDA FS Forest Insect and Disease Leaflet 172 (Revised February 2000)

USDA FS General Technical Report PSW-116; Proceedings of the Symposium on Research and Management of Annosus Root Disease (*Heterobasidion annosum*) in Western North America April 18-21, 1989, Monterey, California.

USDA FS Handbook - R5 SUPPLEMENT 3409.11-2013-1; Forest Health Protection Handbook, Chapter 60 – Management of Specific Pests; Effective Date - 6/10/2013